State Of California | The Resources Agency of California

# Memorandum

**Date :** June 1, 2000
**Telephone:** (916) 653-1614

**To :** William J. Keese, Chairman and Presiding Member
Robert A. Laurie, Commissioner and Associate Member

**File:** June Status Report.Doc

**From :** California Energy Commission - Richard K. Buell
1516 Ninth Street
Sacramento, CA 95814-5512
Siting Project Manager

**Subject :** **THREE MOUNTAIN POWER PROJECT ~ Staff's June 2000 Status Report and Preliminary Water Supply Assessment**

The Three Mountain Power Project Committee's May 19, 2000 order ***Notice of Rescheduled Evidentiary Hearings and Procedures*** directed parties to file a status report on the first of each month. This is staff's June 2000 response to that order.

## *AIR QUALITY*

The Shasta County Air Quality Management District (District) was expected to file its Final Determination Of Compliance (FDOC) on May 23, 2000. It is not clear when the FDOC will be filed. Staff has received information from the applicant regarding road paving and the wood stove replacement program. Staff will be conducting an independent verification of the road surveys.

## *WATER RESOURCES*

Staff indicated that it would file a water supply assessment on May 26, 2000. That submittal was delayed due to staff resource conflicts. Staff's report is attached.

## *BIOLOGICAL RESOURCES*

Staff understands that the applicant is in the process of providing the U.S. Environmental Protection Agency with the information necessary to begin a Section 7 consultation with U.S. Fish and Wildlife Service.

## *ALTERNATIVES*

Staff has nothing new to report regarding its alternatives analysis at this time.

Attachment

RKB:rkb

cc: Three Mountain POS List
Michael Kussow
CVRWQCB
USFWS
CDFG

# PRELIMINARY WATER SUPPLY ASSESSMENT

Linda Bond

## INTRODUCTION

The potential for negative impacts within Burney Basin caused by groundwater pumping and water consumption by the Three Mountain Power Project must be evaluated by means of a sound scientific analysis.  Owing to errors in the conceptual analysis and quantification of the groundwater conditions of Burney Basin that has been provided by the applicant, staff is developing an independent analysis of the  project impacts.  The purpose of this document is to summarize the staff's conceptual analysis of the groundwater system of Burney Basin and to provide a preliminary water budget.

## BACKGROUND

The Burney Basin aquifer is primarily composed of fractured rock called basalt that formed from successive volcanic lava flows.  The basalt is more highly fractured at the head, toe, top and bottom surface of each flow, where the lava cooled most quickly.  Secondary fractures occur along north-south trending fault lines. Groundwater is stored and transmitted through this system of irregular fractures.

The fractured nature of the aquifer affects our ability to predict the behavior of the groundwater system. Unlike a typical sand-and-gravel aquifer, the behavior of a fractured-rock aquifer such as the Burney Basin aquifer is highly variable and difficult to analyze.  The variability of fractures makes predicting the productivity of a proposed well or its drawdown impact on nearby existing wells highly uncertain prior to well installation.  Specific capacities of existing wells in the basin vary widely.  It would also be very difficult to predict the flow path of any leakage that might occur from the proposed evaporation ponds into the groundwater system.

The information that we do have indicates that the Burney Basin is a partially closed groundwater basin.  It is generally enclosed with a major point of outflow at the north end of the basin valley.  However, the topographic divide between the northeast boundary of Burney Basin and the Hat Creek Basin to the east is poorly defined, and may be an area of both inflow and outflow to the neighboring basin. Most of the inflow into the basin is composed of precipitation that occurs within the Burney Basin watershed. In addition, recent isotopic studies (Rose, et. al., 1996, Rose, 2000) indicate that groundwater inflows from the Hat Creek Basin contribute to outflow from Burney Basin. These inflows represent a second source of inflow to Burney Basin. Outflow from Burney Basin include Burney Creek, Burney Falls, Salmon Springs to the east of the falls, and probably several other unmeasured minor spring flows that discharge to either Lake Britton or Hat Creek. Outflows from the basin occur as groundwater seepage to form springs and falls at the northeast boundary of the basin and secondarily, as surface water discharge from Burney Creek. The largest proportion of the outflow of the basin occurs at Burney Falls.

## WATER SUPPLY ANALYSIS

Measurements of inflows, consumption and outflows for Burney Basin are very limited. However, the available data does provide a measure of the general magnitude of flows from the basin. The water budget shown in Table 1 provides the staff's current best estimate of approximate average inflows, consumption and outflows for the basin.

## INFLOW

Inflows include precipitation that falls within the Burney Basin Watershed and groundwater inflows from the Hat Creek Basin. Precipitation, estimated at 417,000 acre-feet/year during average hydrologic years, based on the analysis performed by Lawrence and Associates (4/1999), which derived these estimates from isohyetal maps developed by the U.S. Geological Survey (Rantz, 1969). In addition, approximately 60,000 acre-feet/year of groundwater underflow enters Burney Basin from Hat Creek, based on isotopic analyses developed by Lawrence Livermore National Laboratory (Rose, et. al., 1996, 2000). Total inflows are approximately 477,000 acre-feet/year under presumably average conditions.

## CONSUMPTION

Water is consumed in Burney Basin by unirrigated native vegetation and wetlands, human uses, and possibly snowfall sublimation. Native vegetation and wetlands

**Table 1**
**Water Budget For Burney Basin**
**Approximate Conditions (acre-feet/year)**

| **Inflow** | | **477,000** | **Sources** | **Comments** |
|---|---|---|---|---|
| Precipitation for Burney Basin | 417,000 | | Lawrence & Associates, 4/1999 | |
| Hat Creek (39% of Burney Falls flow) | 51,500 | | Rose, Lawrence Livermore National Labs, 2/2000 | 39% to 47% range of values |
| Hat Creek (50% of Salmon Springs flow) | 8,500 | | Verbal communication, Rose, Lawrence Livermore National Labs, 5/2000 | Rough approximation |
| **Consumption** | | **228,000** | | |
| Snowfall Sublimation (approximately 5% of precipitation) | 19,000 | | DWR, general estimates, verbal communication, 5/2000 | 2% to 10% |
| Unirrigated Vegetation (106,235 acres of native vegetation and 652 acres of wetlands) | 189,000 | | LDBond (5/2000) | Based on CIMIS calculation of ET See Table 2 & 3. |
| Domestic, Industrial, Agricultural | 20,000 | | Lawrence & Associates (4/1999) | |
| **Outflow** | | **249,000** | | |
| Burney Falls | 132,000 | | USGS (1921-1922 Measurements) and CH2Mhill (1988) | 1921-1922 normal-range rainfall year, 1988 drought year |
| Salmon Springs | 17,000 | | CH2Mhill (1988) | 1988 drought year |
| **Approximate Unaccounted Outflow** | **100,000** | | **LDBond (5/2000)** | |

use about 189,000 acre-feet/year, accounting for about 76% of the water consumption in the basin, based on CIMIS (California Irrigation Management Irrigation System) calculations of evapotranspiration. See Table 2 and Table 3. Human activities consume about 20,000 acre-feet/year (Lawrence and Associates, 4/1999) and sublimation may consume about 19,000 acre-feet/year, based on general estimates by the California Department of Water Resources (verbal communication, 5/2000).

## TABLE 2
## Estimate Of Average Evapotranspiration Of Native Vegetation In Burney Basin

| | Total Acreage | Average Evapotranspiration (feet) | Consumption (acre-feet/year) |
|---|---|---|---|
| Evapotranspirationfor Native Vegetation | | | |
| Upland Forest | 106.235 | 1.8 | 186,052 |
| Wetlands | 652 | 4.9 | 3,203 |
| Total* | 106,887 | 1.8 | 189,225 |

Total Average ET = weighted average ET.

## Table 3
## Calculation Of Evapotranspiration Of Native Vegetation In Burney Basin

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| Month | ETo Daily Average (in/day) | Eto Monthly Average (in/mon) | Kc Evergreen Trees | PET Evergreen Trees (in/mon) | Average Precipitation At Burney (in/mon) | Average Precipitation for Basin (in/mon) | ET Evergreen trees in uplands (in/mon) | ET Evergreen trees in wetlands (in/mon) |
| 1 | 0.03 | 0.9 | 1.2 | 1.1 | 4.9 | 7.6 | 1.1 | 1.1 |
| 2 | 0.06 | 1.7 | 1.2 | 2.0 | 4.0 | 6.2 | 2.0 | 2.0 |
| 3 | 0.10 | 3.1 | 1.2 | 3.7 | 3.6 | 5.6 | 3.7 | 3.7 |
| 4 | 0.15 | 4.5 | 1.2 | 5.4 | 1.8 | 2.8 | 2.8 | 5.4 |
| 5 | 0.19 | 5.9 | 1.2 | 7.1 | 1.4 | 2.2 | 2.2 | 7.1 |
| 6 | 0.24 | 7.2 | 1.2 | 8.6 | 0.8 | 1.3 | 1.3 | 8.6 |
| 7 | 0.26 | 8.1 | 1.2 | 9.7 | 0.2 | 0.3 | 0.3 | 9.7 |
| 8 | 0.23 | 7.1 | 1.2 | 8.6 | 0.4 | 0.6 | 0.6 | 8.6 |
| 9 | 0.17 | 5.1 | 1.2 | 6.1 | 0.8 | 1.2 | 1.2 | 6.1 |
| 10 | 0.10 | 3.1 | 1.2 | 3.7 | 1.8 | 2.8 | 2.8 | 3.7 |
| 11 | 0.05 | 1.5 | 1.2 | 1.8 | 3.7 | 5.7 | 1.8 | 1.8 |
| 12 | 0.03 | 0.9 | 1.2 | 1.1 | 4.3 | 6.7 | 1.1 | 1.1 |
| inches/year | | | | 58.9 | 28.0 | 42.9 | 21.0 | 58.9 |
| feet/year | | | | 4.9 | 2.3 | 3.6 | 1.8 | 4.9 |

A ETo, daily average: Reference evapotranspiration, for Zone 10, which includes Burney Basin, from Reference Evapotranspiration (Eto) Zones Map published by the Departments of Land, Air and Water Resources, University of California, Davis and the Water Conservation Office, California Department of Water Resources, Baryohay Davidoff, California Irrigation Management Unit.

B ETo, monthly average: Average monthly reference evapotranspiration; B = A x number of days in month.

C Kc, evergreen trees: Crop coefficients for evergreen trees (statewide value) from Using Reference Evapotranspiration (ETo) and Crop Coefficients to Estimate Crop Evapotranspiration (ETc) for Trees and Vines, published by the Cooperative Extension, University of California, Division of Agriculture and Natural Resources, Leaflet 21428.

D PET, evergreen trees: Potential Evapotranspiration for evergreen trees. D = B x C.

E Average precipitation at the Burney Weather Station 41214.

F Average precipitation for Burney Basin, estimated as follows: 417,000 acre-feet/year of rainfall for Basin/116,564 acres = 3.6 feet/year; therefore, the adjustment factor for monthly precipitation is 1.5 = 3.6 feet/year for Basin / 2.3 feet/year in Burney.

G ET, evergreen trees in uplands: Estimated evapotranspiration for trees with root zones well above the groundwater table. Under these conditions, if PET < precipitation, ET = PET, and if PET>precipitation, ET = precipitation. Precipitation = average precipitation for Basin.

H ET, evergreen trees in wetlands: Estimated evapotranspiration for trees with root zones within the groundwater table. Under these conditions, it is assumed that ET = PET because water is available at all times. It is also assumed that wetlands are vegetated. Adjustment should be made for the portion of the wetlands that are lakes, reservoirs and streams.

## OUTFLOW

Based on the limited measurements, outflows from Burney Basin are approximately 150,000 acre-feet/year through Burney Falls and Salmon Springs during average years. No measurement of variability is available. In addition, approximately 100,000 acre-feet/year of unaccounted outflow appears to occur, most likely as groundwater underflow or spring flow along the northeast boundary of the basin.

Flow from Burney Falls was measured by the U.S. Geological Survey for one year (1921-1922). Burney Falls and Salmon Springs was measured by CH2MHill for one month (September 1988). Reviewing hydrologic conditions during the period of record indications that precipitation in 1921-1922 was near average, while drought conditions existed in 1988. One inconsistency in the existing data is the fact that the measured discharge in September 1922, an average hydrologic year, was lower than discharge in September 1988, a drought year. However, this inconsistency cannot be resolved at this time because no other information specific to Burney Basin is available to evaluate the variability outflow from the basin in wet, normal or dry years. Furthermore, historical change in outflow with changes in water use also cannot be evaluated.

It should be remembered that although a water budget for Burney Basin can be roughly estimated, uncertainty regarding the flow boundaries of the basin and the lack of measured data produces uncertainty in the water budget for the basin. Therefore, any water budget for Burney Basin should be considered a gross estimate.

Given the magnitude of flows in the basin, one can conclude from the water budget that the estimated amount of water that would be consumed by TMPP (approximately 3,000 acre-feet/year) is small compared to the approximate 150,000 to 250,000 acre-feet of water that discharges from the basin during average years. During drought, if outflows from Burney Basin are similar to spring flows measured in the adjacent Hat Creek Basin at the end of the 1988-1992 drought, discharge may decrease between 40% and 50% in Burney Basin also. In these circumstances, water consumption by TMPP would reduce outflows by approximately 4%, at the most [3000 afy/(150,000 afy * 0.50)].

Given this relatively small impact on outflows, the importance of the water budget is to provide a full listing of components in order to identify sensitive components that would potentially be negatively effected by the project.  The two most sensitive components related to the water budget appear to be drought-year declines in outflow over Burney Falls and in spring discharges that support endangered and sensitive species, especially springs that flow into the Hat Creek area.  It is likely that springs which discharge from the upper portions of the aquifer would be the first to dry up, as groundwater levels decline with a drought. Therefore, the decrease in outflow caused by the project would be most significant in relation to ongoing negative impacts to sensitive or endangered species in these areas or to Burney Falls, especially during drought years.

## CONCLUSION

Given the complexity of the groundwater system and the lack of data that is specific to Burney Basin, only general conclusions regarding groundwater conditions and behavior can be substantiated.  Four issues of concern and potential negative impact may occur owing to TMPP:

1. Uncertainty about potentially unacceptable drawdown from the TMPP supply well(s).  Use of supply wells should be conditioned on the actual measured drawdown in existing wells.
2. Potential for leakage from evaporation waste ponds.  Tracer tests and flow evaluation with a comprehensive monitoring plan should be included in conditions to guard against ground water contamination.
3. The significance threshold for decreases or cumulative impacts to flows to Burney Falls, especially during drought.
4. Potential cumulative negative impacts to biology in areas of groundwater and surface water discharge in the northeast portion of the basin.

Finally, the applicant in its submittals about the conditions of Burney Basin has reached unsupported conclusions.  There is insufficient data available to conduct the analyses reported by the applicant, and thus, to reach conclusions regarding the projects impact at the level of specificity claimed by the applicant. Moreover, although the applicant cites the available data, significant portions of its analysis, such as the conclusions about inflow to and outflow from Hat Creek are in fact contradicted by what information we do have about the Burney Basin. Therefore, staff has developed this analytical approach, which focuses on establishing an accurate characterization of the flow system, rather than speculating about the exact level of impacts.

## REFERENCES


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